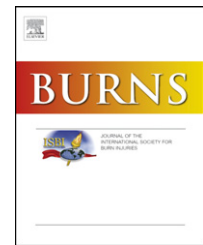


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Methylated spirit burns: An ongoing problem

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ABSTRACT

Objective: Despite many educational campaigns we still see burns caused by methylated spirit every year. We undertook a retrospective study to analyse the impact of this problem. **Methods:** We retrospectively collected data of all patients with burns caused by methylated spirit over twelve years from 1996 to 2008. Our main endpoints were: incidence, age, mechanism of injury, total body surface area (TBSA) burned, burn depth, need for surgery and length of hospital stay.

Results: Ninety-seven patients with methylated spirit burns were included. During the study period there was no decrease in the number of patients annually admitted to the burn unit with methylated spirit burns. 28% of the patients ($n = 27$) were younger than eighteen years old, 15% ($n = 15$) were ten years old or younger. The most common cause of burns was carelessness in activities involving barbecues, campfires and fondues. Mean TBSA burned was 16% (SD 12.4). 70% ($n = 68$) had full thickness burns. 66% ($n = 64$) needed grafting. Mean length of hospital stay was 23 days (SD 24.7).

Conclusions: The use of methylated spirit is an ongoing problem, which continues to cause severe burns in adults and children. Therefore methylated spirit should be banned in households. We suggest sale only in specialised shops, clear labelling and mandatory warnings.

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1. Introduction

Despite educational campaigns there are still many burn accidents in the Netherlands where methylated spirit is involved. Every summer the Dutch burn foundation organises a national campaign in newspapers, on television and on the Internet to educate about safety and dangers of barbecuing. There is a special website with extensive information and education about precautions, instructions for ignition and safety rules for children during barbecue activities. Especially the danger of accelerants like methylated spirit is mentioned. There is no specific campaign about the use of methylated spirit in other activities.

Frequently the burn accidents happen when methylated spirit is misused to initiate ignition of barbecues and campfires. Although there are better and safer alternatives for that purpose, methylated spirit is a cheap liquid that is available in every local supermarket and is even located near barbecue equipment and charcoal. It is present in almost every household. In addition it is notable that containers of methylated spirits have no warning labels, which relate to the dangers of misuse.

Previous studies on burns related to methylated spirits have been reported. In 1977 Sinclair [1] reviewed barbecue burns in which methylated spirit was the main cause and since that time further studies have been conducted to evaluate barbecue burns and campfires [2–6].

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Although the misuse of accelerants was the main cause of burns in those studies, the main focus was on barbecues and campfires and other mechanisms of injury were also included. A study of Pegg et al. [7] reviewed cases of all kinds of domestic flammable agents.

Because methylated spirit burns are seen in our burn centre not only in relation to barbecue activities and campfires, methylated spirit is the starting point in this study. This is the first study, which is focussed exclusively on methylated spirit burns.

2. Patients and methods

The burn centre of the Red Cross Hospital is one of the three burn centres in the Netherlands thus serving a substantial portion of the Dutch population. Each year about 230 patients are admitted to this unit for burn wound care. This is about 40% of the total population of burn patients admitted to the 3 burn centres in the Netherlands. There is also a large outpatient clinic with approximately 400 new patients each year.

The database of our burn centre was accessed to identify all patients who were admitted with burns in which methylated spirit was involved from January 1996 to December 2008. From each patient the following parameters were recorded: year of injury, age at injury, gender, mechanism of injury, total body surface area burned, burn depth, surgery and length of stay.

The statistical analysis was performed with SPSS (version 16.0.1) on a personal computer. Categorical data are presented as the number of subjects in the category, along with the percentages. All continuous data are given as means with SDs. The Chi-square test and Fischer's exact test were used to compare the patients who sustained burns by either a barbecue or a fondue accident on categorical variables as burn depth,

gender and surgery. The independent Student's t-test was used to compare these two groups on continuous data as total body surface area, length of hospital stay and age.

3. Results

From 1996 to 2008 ninety-seven patients were admitted to the burn centre of the Red Cross Hospital with burn wounds caused by an accident with methylated spirit. The annual incidence is shown in Fig. 1. The mean incidence of hospital admittance was 7.5 patients a year.

Sixty-three patients were male (65%) and thirty-four female (35%, ratio 1.9:1). Their age ranged from 2 to 78 years (mean 29.7 years, SD = 17.7). Twenty-seven patients were classified as children (<18 years) with 20 males and 7 females (ratio 2.9:1). In this paediatric group 15 patients were 10 years old or younger, which represents 56% of the paediatric group and 15% of the study group as a whole (Table 1).

The total body surface area (TBSA) of the burns ranged from 2% to 79% (mean 16%, SD = 12.4). In the paediatric group it ranged from 2% to 30% TBSA (mean 13%, SD = 8.6). The burn depth of most patients was a combination of dermal and full thickness ($n = 68$, 70%). The remainder had a burn depth of combined superficial and deep dermal ($n = 29$, 30%). Excision and grafting of the burns was undertaken in 64 patients (66%). In the paediatric group 20 patients (74%) needed excision and grafting. The length of stay ranged from 0 to 137 days with a mean of 23 days (SD = 24.7). Two patients in the study group died as result of their burn wounds.

Analysis of the mechanism of injury revealed that the misuse of methylated spirit to ignite barbecues was the most common cause of injury and occurred in 35 patients (36%). Another common cause was pouring methylated spirit on fires (campfires and fire baskets), which occurred in 18 patients

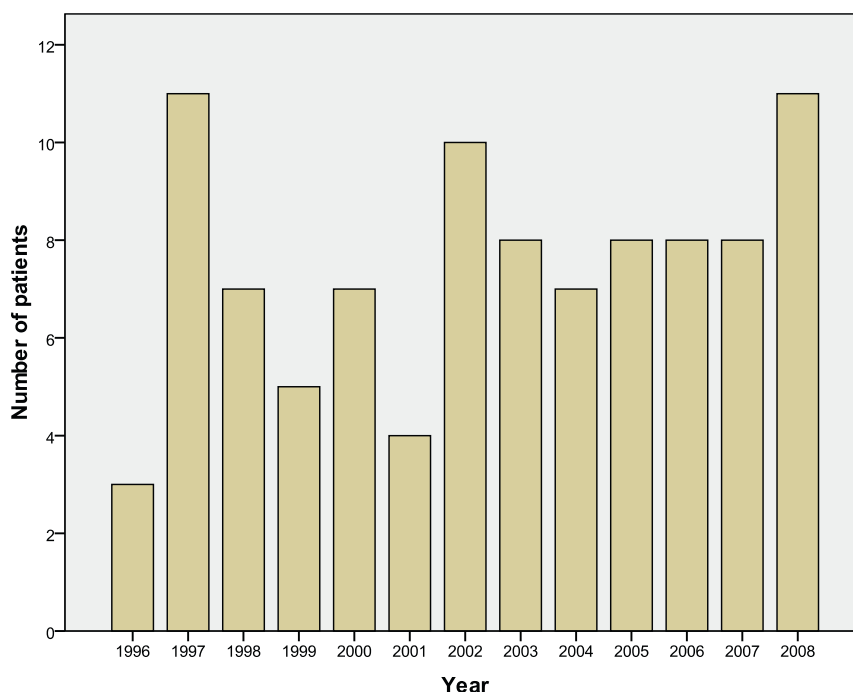


Fig. 1 – Incidence of methylated spirit burns.

Table 1 – Characteristics of the study group.

Variable	N	Mean (SD) or %	Minimum	Maximum
Gender				
Male	63	65%		
Female	34	35%		
Age (years)	97	29.7 (17.7)	2	78
Age < 18 years	27	28%		
Bystanders	52	54%		
TBSA (%)		16 (12.4)	2	79
Mixed dermal and full thickness	68	70%		
Mixed superficial and deep	29	30%		
Surgery (n)	64	66%		
Length of stay (days)	97	23 (24.7)	0	137

(19%). Other injuries occurred during gourmet and fondue when methylated spirit was poured into a burner, which was still alight ($n = 12$, 12.5%). Further causes related to the use of methylated spirit in suicide attempts ($n = 7$, 7%) in igniting a fireplace ($n = 6$, 6%) and in the use of spirit burners ($n = 6$, 6%). The remaining causes consisted of accidents during cleaning, use of methylated spirit to kill insects, playing, attempts on somebody's life and explosions and accidents not otherwise specified ($n = 13$, 13.5%; Table 2).

A total of 54 of patients (56%) were bystanders, including 23 out of 27 patients (85%) in the paediatric group.

There was no significant difference in TBSA of burns between bystanders (14.5% TBSA) and self-inflicted burn patients (19% TBSA) ($p = 0.115$). Both groups underwent equally frequent operative treatment (66.7% vs. 67.6%).

There was no difference in age, depth of burn, need for operation or length of hospital stay in patients, who sustained burns by either barbecue or fondue accidents. Nevertheless there were more male patients in the barbecue group (24 males, 11 females) and more females in the fondue group (4 males, 8 females) ($p = 0.045$).

4. Discussion

Methylated spirit is a very volatile liquid and the vapour is highly inflammable. It consists of a mixture of ethanol (85%), water (10%), methanol (3%), acetone (1%) and pyridine (1%) and is mainly used in households as fuel or as cleaning product. It is available in every local supermarket and can be found in almost every household. In spirit burners methylated spirit is used as fuel for fondue and gourmet sets. Dissolved in water it is used for cleaning windows to prevent freezing of water and to prevent stripes, although it produces a blue haze on the

cleaned windows. In more professional way is it used in camping and trekking activities as fuel for a camping stove although nowadays gas is used more frequently. However methylated spirit is often misused in barbecue activities. When ignition of a barbecue fails or is too slow to start with safe firelighters it is used as accelerant.

Our results showed an incidence of slightly less than 8 patients a year.

Although this is only 3% of our inpatient population it is a significant problem because of the great number of children and bystanders who are not able to avoid an accident. Furthermore the most frequent mechanisms of injury (barbecue, campfire, gourmet and fondue) are usually family or group activities where accidents have great emotional impact as in general every burn has great impact on the individual patient.

This study showed that there was no decrease of hospital admission for burns caused by methylated spirit. However, during the study period the overall incidence of all burn accidents in the Netherlands decreased (Fig. 2). Therefore can be stated that there is a relative increase of methylated spirit burns.

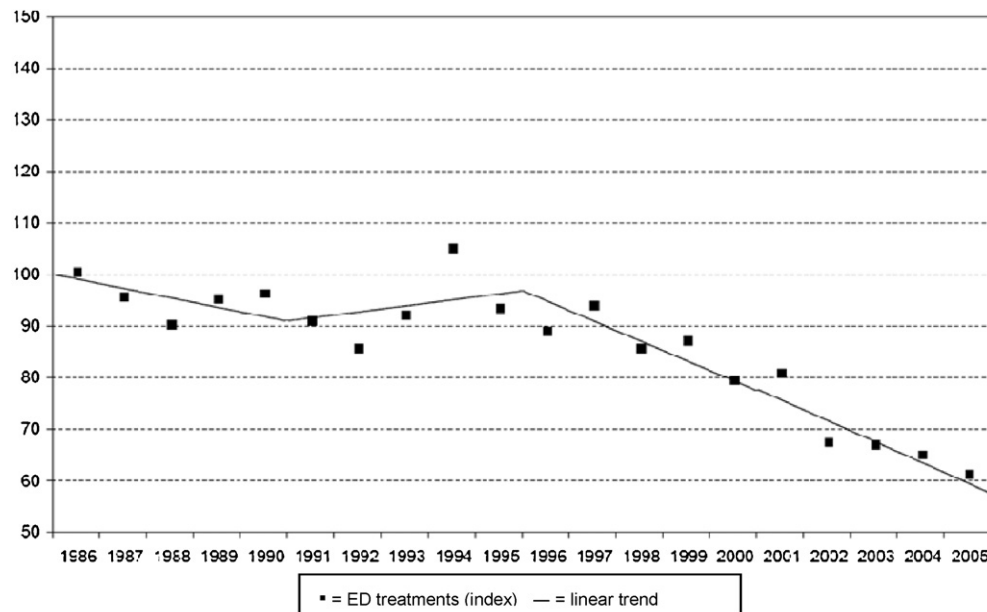
The overall decrease of burn accidents in the Netherlands is due to specific educational campaigns of the Dutch burn foundation in which prevention of fire accidents and burns is the main part. Therefore the presence of smoke detectors and fire blankets at home has increased. A possible reason for the relative increase of burns caused by methylated spirit could be that the main mechanisms of injury (misuse in barbecuing and outside fires) are outside activities where the preventative measures are less useful. Another reason could be that barbecuing and making campfires in the Netherlands are seasonal activities taking place only during summer.

The predominance of male patients is equal to all previous studies in the literature [1–7]. It also corresponds to the Dutch epidemiology where more male burn patients are admitted to the hospital each year [8]. It is partially caused by historical and social circumstances where males predominate in barbecue activities and fire making. Therefore the female predominance in fondue accidents is more special and probably based on the habit of women taking care for in home fondue activities, while man are involved in ignition of the barbecue and fires outside.

The most frequent mechanism of injury is the misuse of methylated spirit during barbecue activities, campfires and fire baskets. Often methylated spirit is poured or thrown onto

Table 2 – Mechanisms of injury.

Mechanism of injury	N	%
Barbecue	35	36
Fire (campfire + fire basket)	18	19
Gourmet and fondue	12	12.5
Suicide attempt	7	7
Fireplace	6	6
Spirit burner	6	6
Other	13	13.5



Source: Injury Information System, 1986–2005, Dutch Consumer Safety Foundation

Fig. 2 – Incidence of emergency department treatments for burn accidents (corrected for demographic changes; Index: January 1986 = 100).

Injury Information System, 1986–2005, Dutch Consumer Safety Foundation.

already ignited fires. By doing so not only does the liquid ignite but the vapour explodes and commonly also the whole bottle. Often the flash fire ignites clothing, which further increases the severity of the injury. In many cases the fact that methylated spirit burns with an invisible flame leads people to believe that the barbecue or fire had not ignited or had gone out. The difficulty in visualising the flame is also related to accidents when methylated spirit is poured in burners from fondue and gourmet sets.

It is important to identify the fact that there are no warnings on methylated spirit bottles in the Netherlands relating to the dangers in its use. Sinclair [1] suggested clearly that warnings should be used, Jurell et al. [9] recommended clear labelling of the dangers of misuse and Pegg et al. [7] suggested legislation to ensure this labelling.

When methylated spirit vapour explodes, the flash fire produces burning droplets in the opposite direction which can cause flash burns or ignite the clothing of bystanders. More than half of the patients in this study were burned in this way. This was particularly prevalent in the paediatric group accounting for 85% of the burns. This accounts for the relatively large number of, mostly young, children in this study. This suggests that children are often too close to the barbecue or fire. Although mentioned in 1977 by Sinclair [1] and again by Khalessi et al. [4] who found only two bystanders in a study population of 80 patients the prevalence of burns in bystanders has not been well emphasised in the literature.

A difference with literature is the fact that all children had flash and flame burns, where other studies found mainly contact burns [3,5]. One explanation might be that other studies have chosen barbecue activities as starting point and

therefore comparison is difficult. Also a difference is that in other countries gas barbecues are used more often.

Another important outcome is the severity of the burn wound and the high percentage of patients who needed excision and grafting (66%). This percentage is significantly higher than stated in literature before. Sinclair reported 10% of patients needing excision and grafting, Regan et al., 57%, Pellard et al. only 7% and Khalessi et al. 20% [1–3]. However these studies also included other causes of burns related to barbecue activities like contact burns which again makes it difficult to compare results.

Our results pointed out that burns by methylated spirit are still a problem.

Certainly when it is kept in mind that only admitted patients to our specialised burn centre were included in our study. This means that patients with minor burns caused by methylated spirit who presented themselves in the emergency department and treated in our outpatient clinic have not been included. This also applies to those who are admitted to other general hospitals.

Although some authors state that methylated spirit is a safe product when it is applied to cold fuel [1,3], we think that based on our results this is not true.

With no warnings and no user manual on the bottles it is a product that has a very small range of safe use. For that small range we suggest that it should be sold in specialised shops and not in every local supermarket. Based on our findings there must be a label on the bottles with a clear warning not to use it as ignition fluid. Supermarket organisations and companies must be aware of the dangers in use and be convinced, if they still want to sell it, that it should not be

placed on the same shelf as the barbeque accessories. The use of safe ignition products (firelighters) should be propagated.

We have discussed these recommendations with the Dutch Burn Foundation. In consultation of that foundation we are in contact with the Ministry of health and supermarket organisations.

5. Conclusion

Although there were public education campaigns about burns caused by methylated spirit misuse, the incidence has not been decreased in the Netherlands. The frequent misuse of methylated spirit in barbecue, fondue and campfires can cause serious burns in a relatively young population who are often bystanders. The easy availability of methylated spirits contributes to this problem. This study suggests that methylated spirit is a liquid, which has no place in households. There are many alternatives for cleaning, for barbecues there are safe firelighters and for fondue or gourmet there are disposable burners or electric equipment. Consequently we suggest that methylated spirit should be banned from supermarkets and should only be available in specialised shops with clear labelling and mandatory warnings.

Conflict of interest

None.

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REFERENCES

- [1] Sinclair SW. Barbecue burns. *NZ Med J* 1977;86:524.
- [2] Regan PJ, Budny PG, Lavelle JR, Roberts AHN. Bonfire and barbecue burns. *Burns* 1991;17(4):306–8.
- [3] Pellard S, Camp D, Potokar TS. Banger burgers and burns. A 10-year review of barbecue burns in South Wales. *Burns* 2006;32:913–5.
- [4] Khalessi A, Maitz P, Haertsch P, Kennedy P. Adult burn injuries due to domestic barbecues in New South Wales. *Burns* 2008;34:1002–5.
- [5] Philips BJ, Kassir A, Anderson B, Schiller WR. Recreational-outdoor burns: the impact and severity – a retrospective review of 107 patients. *Burns* 1998;24(6):559–61.
- [6] Klein MB, Heimbach DM, Honari S, Engrav LH, Gibran NS. Adult campfire burns: two avenues for prevention. *J Burn Care Rehabil* 2005;26:440–2.
- [7] Pegg SP, Beecham L, Dore N, Hrdlicka D, Hukins C. Epidemiology of burns due to domestic flammable agents. *Burns* 1990;16(2):113–7.
- [8] Dutch Consumer Safety Foundation, for the Dutch Burns Foundation, <<http://www.brandwonden.nl/page/418>>.
- [9] Jurell G, Kjartansson J, Malm M. Accidental burns with domestic fire lighting fluid. *Scand J Plast Reconstr Surg* 1984;18(1):155–6.